



## University of Pittsburgh

LEARNING RESEARCH AND DEVELOPMENT CENTER

17 October 1977

Prof. Joshua Lederberg  
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Stanford, CA 94305

Dear Prof. Lederberg:

This letter is an amplification of certain aspects of the proposal that James Greeno and I made to SUMEX-AIM on 29 July 1977. Its purpose is to indicate the extent to which we are proposing research that will involve NIH target populations. I will briefly comment on four aspects of the proposed work that relate to this issue: (a) the overall nature of the research projects in which the proposed work is embedded; (b) the general adaptability of the simulation medium we are proposing to use (ACT) for studying learning deficits; (c) specific aspects of the proposed reading research that relate to impaired learners and children who are not learning well in school; and (d) similar aspects of the proposed work in mathematics.

LRDC research goals. The work at LRDC of which our efforts are a part is directed at improvement of elementary school instruction. The work has been aimed, for the most part, at developing the understanding necessary for the construction of a truly adaptive curriculum in the basic skills areas. In principle, much of the work in which we are engaged is not specifically addressed to the problems of those who have learning deficits. However, the nature and cost of the approaches that have been developed at LRDC have made them most often used with students who are hard to teach, i.e., those in urban public schools and, in recent years, those in learning-disability classes. In particular, the adaptive or individualized approach is well suited to current demands for mainstreaming of children who are, in one sense or another, handicapped. Thus, the research we are proposing will be embedded in an overall research and development effort which has above-average promise of affecting children with learning deficits.

Suitability of ACT simulation for this work. Another general point to be made is that the simulation language we will be using, Anderson's ACT system, is well suited to the exploration of the effects of certain types of cognitive deficits on academic performances. The parameters that control overall function of ACT are directly tied to concepts that are often discussed in theories of learning disability. For example, it is possible in ACT to directly represent differences in short-term memory by adjusting a single parameter. Through a combination of adjustments in the system parameters and in weightings given to individual productions (the

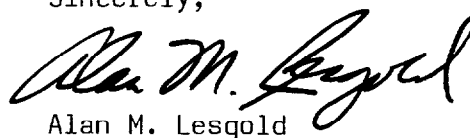
micro-units of the simulation), it is possible to simulate differing conceptions of the attentional deficits that are often claimed to be present in learning-disabled children. Further, the use of ACT allows a clear separation between system dysfunctions and lack of cognitive skills.

The proposed reading work. As discussed in the proposal, the simulation work I propose to carry out on reading processes involves three basic steps. First, the language coding deficits of slow and otherwise poor readers will be isolated and specified in terms of an ACT model of word recognition. Second, a model will be built of the processes whereby sentences that are read are related to what has already been understood from earlier parts of a discourse. Finally, both the word recognition and the understanding processes will be combined into a single simulation. In this way, we hope to generate predictions of some of the specific understanding problems that can arise when language code processing functions are inadequate. The primary group to be modeled is the pool of children who, while showing no hard or soft signs of medical impairment, still are not doing well in school. However, we are also interested in the learning-disability population. Indeed, as part of the non-simulation component of my research, I am currently comparing, with Isabel Beck, another LRDC researcher, LD children's oral reading skills to those of "normal" children of different ability levels. Thus, by the time the simulations have been designed, we will have reading performance data on both LD and unlabelled slow readers. It will be interesting to see whether adjustment of ACT's parameters is necessary to capture the reading behaviors of the LD kids or whether they are modelled sufficiently by variation in the productions they are thought to have learned, or how well they have learned them.

The proposed arithmetic work. We are still at the stage of developing models of the basic processes of comprehending and using arithmetic operations. When we have made some progress with that task, it will become possible to begin to differentiate levels of arithmetic proficiency and their causes. This is a goal with considerable appeal to Greeno and his research group, and we expect that comparative studies to provide analyses of sources of learning difficulty will be included in the program as quickly as they become theoretically feasible. One relatively imminent possibility involves a model of comprehension states in the understanding of word problems that Greeno is developing in collaboration with Mary Riley, a graduate assistant on the project. It is anticipated that this model will identify processes associated with syntactic and semantic components of the comprehension processes. If preliminary work with this model is successful, we anticipate developing a study in which parameters of the model would be related to students' skills in various domains, including reading and arithmetic achievement.

I hope the above has clarified the issue that your advisory committee raised. If you need further information of any sort, please feel free to contact me by phone, mail, or via the GREENO SUMEX-AIM account.

Sincerely,



Alan M. Lesgold